Eyestrain: Its Causes and How
to avoid it
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AMERICAN FOUNDATION
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v. 4, no. 1. HV2334
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# Eyestrain: Its Cause and How to Avoid It

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THE structures of the eye are so delicate and so easily damaged that any injury or inflammation should receive immediate and skilled attention. An eye containing a foreign body, such as dust, soot, metal scrap or glass that cannot easily be removed, or an eye that has been cut or scratched, should be closed and tied up immediately with a bandage or a clean handkerchief until a physician can be consulted.

The most sensitive and highly specialized organ of the body is the eye. What organ, aside from the heart, is more constantly used during our waking hours?

Consider for a moment the anatomy of the eye. The first thing about an eye to attract our attention is the beautiful color of the iris surrounding the pupil. If we look carefully we shall see that the iris is not on the surface, but that we are looking at it through a beautifully clear, transparent membrane, convex in form, called the cornea. Between the cornea and the iris is a small space filled with a watery fluid—the aqueous humor. Back of the pupil, which is simply a hole in the iris, or colored membrane, is the crystalline lens, a biconvex solid body, in youth and health clear as crystal. Back of the lens and filling out the cavity of the globe is the vitreous humor, a transparent jelly. Lining the eyeball is the retina, a delicate nervous membrane made up of the expanded fibers of the optic nerve which enters at the back of the eyeball. The outer layers of the retina and the choroid outside of it are deeply pigmented, converting the globe into a "dark box," or camera. The strong, fibrous membrane giving form to the globe is called the sclera from its hardness.

## *Eyestrain*

The most widespread of all eye troubles is eyestrain. Eyestrain and its effects cause more pain and disability than all other eye troubles put together. It probably is responsible for more headache than all other things, to say nothing of eye pain and fatigue, facial spasm, nervous dyspepsia, nausea, vertigo, general fatigue and nervousness, lack of power of concentration, sleeplessness and many other ills. As we ordinarily consider it, eyestrain is due to our efforts to use our imperfect eyes without correcting glasses, or with glasses improperly fitted, but a perfect eye may be strained by improper use, by too much work without proper periods of rest, and by use in bad light. Defective eyes, however, cause the most trouble, and there are very few eyes indeed in which no measurable optical defect can be found. Only about 10 per cent of all eyes conform so closely to type that they may be called normal. At least 60 per cent are so defective as to cause ill health, reduced efficiency or poor sight. The defects of the balance are compensated for by a vigorous accommodation in strong or insensitive individuals, mostly in outdoor occupations.

In order to understand eyestrain and its results, one must have a fair comprehension of the function of the eye and of its defects. We do not literally see with our eyes; we see with our brains a picture formed in the eye acting as a living camera. The cornea, the aqueous humor, the crystalline lens and the vitreous humor constitute its refracting system, the optical center of which is at the posterior surface of the lens. The iris is a perfect diaphragm, automatically contracting and dilating to regulate the amount of light entering the eye, and at all times shutting out marginal rays. The delicate retina not only forms an excellent screen for the reception of images, but has the marvelous power of transmitting these impressions through the fibers of the optic nerve to the brain as definite sensations. Rays of light entering the eye from an external object will undergo a series of refractions, all tending to make them more convergent, and a real and inverted image will thus be formed of any external object to which the eye is directed. If this image falls on the retina, the object is seen; if the image thus formed is sharp and sufficiently luminous, the object is seen distinctly.

Imperfect vision may be due to faulty development of the eye, to acquired optical defects, to changes in the tissues of the eye, or to disease or injury of the brain. One may have a perfect eye and yet be quite blind, because of a tumor of the brain or an injury of the optic nerve.

The refraction of the eye is its power, when at rest, to focus parallel rays of light. The accommodation is the power of the eye to adapt itself to vision at different distances. The chief factors of accommodation are the elasticity of the lens and the action of the ciliary muscle. By the action of this little muscle within the eye, the lens assumes a more spherical form. As the convexity of the lens increases, the refractquickly out of a soapy porcelain bathtub, rushes down icy steps or runs over icy walks.

What about the poisons in your medicine closet? Is the skull and crossbones sufficient protection against misuse? Perhaps the point of a pin sticking up through the cork will be an additional warning. Better still, there should be a separate closet for drugs that children are curious about and that adults may take by mistake.

Keep tools and sharp knives where the youngsters cannot get them to use on the furniture, and their fingers. These should be kept in a separate drawer out of the reach of children.

Guns, if one must have them, should be locked away from children. "I didn't know it was loaded" is a senseless alibi.

Stepladders should make climbing easy and safe. Be sure that they are in good repair and are set up securely.

Electric irons, left connected on ironing boards, have started many fires. Disconnect your iron when you are called away from the board.

Celluloid will ignite from a hot radiator or a curling iron. Every one should be cautioned about its inflammable and explosive qualities.

Gasoline gives off vapor at an ordinary temperature; it is highly explosive. The vapor is heavier than the air and settles near the floor; opening a window will not always clear the atmosphere. Use gasoline in a room in which a door can be opened. Friction of clothing cleaned with gasoline, especially silk, wool or fur, frequently will generate a spark and cause an explosion. Handle gasoline as you would gunpowder; it is dangerous.

A small break in the skin is large enough to let in enough germs to cause infection. Most cases of blood poisoning are not from severe injuries, but from neglected small cuts, scratches, slivers and pricks—the kind that seem too small to bother with. Iodin—a small bottle of it—should be kept in the locked cabinet for poisons and should be used on an abrasion, cut or prick.

Poisoning by food is common. Canned foods and shellfish frequently cause illness and death. Only the best grades of canned goods should be used and the cans should be emptied immediately when opened. Only fresh shellfish should be eaten.

Burns cause 8,100 deaths a year. Burning, and scalding are accidents which occur most often in the kitchen. Each year 1,000 children are burned to death from playing with matches. Boiling water should be treated like poison or fire. Mothers should be cautioned to keep matches out of the reach of children and to turn the handles of hot pots and pans away from the edge of the stove.

Gas kills more than 3,600 people each year; nearly this number of people die from liquid poisons and impure foods. Blood poisoning from infected wounds takes a tremendous toll of lives to pay for our thoughtlessness and carelessness. Babies are disfigured or blinded because their inquisitive natures led them too near a pot of coffee or a pan of steaming cereal. Mothers should not be too busy to pick up fallen pins and needles and to put out of reach thimbles, coins and beans. Slipping on a carelessly thrown banana skin has caused meningitis; a littered, worn, unbanistered or unlighted stairway can be the direct cause of a crippled existence.

What can we do to prevent accidents in the home so that by the end of another year the toll under this classification will be at a minimum? We must increase our watchfulness and carefulness. We must keep a rigid account of ourselves so as to perfect ourselves in home safety; we should be the "safety managers" of our homes. Children quickly adopt our methods; they imitate our every act.

"It behooves parents and older children to eliminate their reckless habits, if they would have the younger children acquire safe ones. It is difficult to establish an age line for safety teaching," says Mrs. Joseph Wilson in the *National Safety News*.

"The only age limit that can be placed on the teaching of safety is the time when the child first begins to imitate. The infant's first world is his mouth and as soon as he can use his hands, everything that his little hands can grasp goes into his mouth. It may be a poison, or some substance that will cause choking. A child 2 years old may not know the meaning of the word match or the danger of striking one, but if he sees father light a match by striking it on the table or window sill, he will try to imitate father and will start a flame the first chance he gets. Correct habits on the part of adults will set a proper example for the child and will prevent many injuries."

Adults should familiarize themselves with the safety and educational organizations of the community in which they live.

The National Safety Council has made a study of accidents and has prepared comprehensive handbooks, charts, posters and other literature covering various forms of accident prevention, all based on accidents which have happened and which are still happening. They are conducting surveys and campaigns to show the need and to suggest ways of alleviation. Private organizations, industries, and the railroads are making headway with their educational work in accident prevention. The Red Cross in its educational department is making a nation-wide effort to educate along the lines of prevention and first aid. It is the woman in the home that safety organizations are so anxious to reach. She needs a background to help her to see, to know, to prevent and to care for, if the occasion demands.

ing power of the eye is increased and it is adapted to vision at a near point. In the normal eye, parallel rays of light, or those coming from a distance, are focused on the retina when the eye is at rest, without the aid of accommodation. Such an eye is said to be emmetropic.

### *Hyperopic or Farsighted Eyes*

The hyperopic eye is the short eye, the undeveloped eye. Obviously, parallel rays would be focused by such an eye, when at rest, at some point back of the location of the retina if the misplaced retina did not interpose. A blurred image will be formed on the retina in its faulty position. Persons with such eyes are sometimes spoken of as farsighted, because they see more easily in the distance than at the near point, though they see nothing clearly at any distance without an effort.

All human beings are born hyperopic; the new-born baby sees nothing distinctly. He often reveals but little muscular coordination either, and alarms his mother by looking crosseyed. If the baby is well nourished, and escapes the serious diseases of infancy, the eyes grow and round out with the development of the body generally. Many children of school age, however, have defective eyes. As soon as they are confined in a schoolroom, which is perhaps not too well lighted, and begin to use the eyes more at reading distance, they begin to have red eyes and to complain of headaches, or of other symptoms of eyestrain. When proper glasses are worn the hyperopic eyes remain healthy and strong, as the eyestrain is relieved. When errors of refraction are not corrected early, the tendency is toward the development of myopia, or nearsight, especially if there is much astigmatism and if the eyes are improperly used, in bad light or in bad position. Usually headache, restlessness, nervousness, or apparent dulness and stupidity appear first. The backward child is usually a defective child and easily becomes a truant.

### *Myopia or Nearsighted Eyes*

In myopia parallel rays of light come to a focus in front of the retina. Usually this defect is due to straining an eye the coats of which are perhaps already weakened by malnutrition. The person affected sees nothing in the distance clearly without the aid of concave glasses, but he may be able to see well at the near point without glasses, even to an extreme age. The myopic eye is diseased, and the condition tends to increase, with constantly diminishing vision and destructive changes in the retina of the eye. In many cases blindness results. Except for a very few congenital instances, all could be prevented; a tendency to myopia is often inherited.

In astigmatism the refraction is not the same in all meridians. The condition is usually due to imperfect curvature of the cornea and ordinarily is congenital. Seventy-five per cent of all eyes are more or less astigmatic. In high degrees of astigmatism it is impossible for the patient to improve his sight by any effort, and he ceases to try, contenting himself with his poor vision and losing his symptoms of strain. In the low and moderate degrees of astigmatism it is possible, as in farsightedness, to improve the sight by an unconscious effort, from which symptoms of eyestrain result.

Some of the worst instances of headaches seen by physicians are those of indoor workers, with perfect vision, who see well only at the expense of constant effort. When the necessity for the excessive use of the accommodation is relieved by glasses, the headaches cease promptly. Eyestrain is not inconsistent with perfect vision.

Just as all our tissues become denser and firmer with age, so the crystalline lens becomes progressively harder and less responsive to the action of the ciliary muscle that controls its shape. The lens really begins to lose its elasticity early in life, but when the person with normal vision can no longer read at a convenient distance, he is said to be presbyopic. Presbyopia usually occurs at about the forty-fifth year, and convex glasses then become necessary for reading and other near work.

### *Faulty Muscle Balance*

Whenever we look at anything, far or near, those of us who have two useful eyes not only focus each eye for the proper distance, but also bring both eyes to bear on the object, in order to secure the advantage of stereoscopic vision. It is by means of binocular, stereoscopic vision that we estimate distance and appreciate the shapes of objects. A person who has lost one eye is much handicapped. After a time, however, the one eyed man acquires a new ability to estimate distance. This new sense probably has some relation to the amount of accommodation used in seeing clearly objects at different distances. Binocular single vision is made possible by the harmonious, coordinated action of six pairs of muscles.

Sometimes for one reason or another, these muscles fail to act in harmony, and the person is obliged to make a constant unnatural effort to keep his eyes "in line." This constitutes one of the most troublesome forms of eyestrain and sometimes the most difficult to remedy. Most cases of eyestrain due to muscle imbalance can be relieved by careful study and treatment and by repeated changes of lenses, but some cannot be permanently helped, except by operation.

### *Crosseye*

Some farsighted children, especially if one eye is more defective than the other and there is little impulse to binocular single vision, become crosseyed. The explanation is usually simple. Probably such children in nine out of ten cases can be cured without an operation, if treatment can be begun early and the active cooperation of the parents secured. In some cases treatment should begin as early as the age of 2 years; if it is delayed until 6, cure may be impossible without operation. The word "cure" means here the restoring of single vision with the two eyes as well as perfect parallelism.

### *Faulty Lighting Causes Eyestrain*

One of the most prolific sources of eyestrain is faulty illumination. The eye "reacts" most easily in steady diffuse daylight, such as we get in our offices and homes for a few hours on clear days, from a north window; few who work in the city have uniform daylight long enough for good work. The problem is to obtain that form of illumination which will make for the greatest visual efficiency. Too little light of any kind will strain the eyes, because small objects must be held very near in order to get a larger retinal image than would be necessary in stronger light. As the amount of accommodation and convergence used are directly dependent on the nearness of the object, the nearer we are obliged to approach the thing we wish to see, the more effort we will expend in order to see it.

There is a great variation in the amount of light required by different persons, and at different ages, in order to see easily. Generally speaking, the older we grow, the more light we require. We should always remember that more harm comes from glare and too much light than from not enough; we should strive to obtain a soft indirect light, which gives clear vision with the least discomfort.

### *Avoiding Eyestrain*

The chief problem in the care of our eyes is to avoid eyestrain. Every child should have a careful physical examination before beginning school work in order to discover any defects. Those defects that can be remedied should be corrected. If there are defects that cannot be helped, the life of the child should be so adjusted as to enable him to accomplish the most with the least wear and tear. All of us may dislike to see children wear glasses, and no doubt the constant use of spectacles interferes somewhat with a boy's normal activities, but often much can be accomplished by wearing glasses for near work only. The early correction with glasses of farsightedness and astigmatism often prevents the development later of nearsightedness, with its serious consequences. Records show that the early use of glasses often promotes the normal growth of the eye. Thus spectacles may frequently be discarded after a few years. Sometimes, indeed, they are of use to bridge over a period of special stress and may be discarded after a few months or a year. Glasses that are needed and that are properly fitted can do no harm, but only good. If they are not needed or are improperly fitted, they will usually be rejected and not worn.

Changes with body structures, including the eyes, are occurring constantly, and the eyes should be reexamined from time to time, and the lenses readjusted to meet the changing needs. The question of constant use of glasses at any age is an individual matter, and must be decided after due consideration of the condition of the eyes and the nature of one's work. The adjustment of the lenses before the eyes is of great importance, because we get the true effect of a lens only when we look through its center at right angles to its plane. A lens for the correction of astigmatism has an axis that must be parallel to the best meridian of the eye. If astigmatism is not accurately and constantly corrected, the relief of eyestrain is not only incomplete, but may be aggravated.

### *Dilating the Pupil*

Examination of the eye without dilation of the pupil is unsatisfactory, since one cannot see the interior of the eye through the small pupil. The conditions disclosed by the use of the ophthalmoscope when one looks through the dilated pupil are often of the utmost importance to the patient. When there is any accommodation left, it is impossible accurately to measure the optical defects of the eye without first paralyzing the ciliary muscle.

For these reasons physicians use atropin and homatropin, the drugs that dilate the pupil. The advantages of the method outweigh the disadvantages a thousand fold.

### *Glare and Excessive Light*

Frequent exposure to glare and excessive light causes irritation and congestion of the tissues of the eye and predispose to inflammation, cataract and chronic weakness of the eyes. Indirectly, there is much fatigue from exhaustion of the retina and spasm of the pupil. Indirect illumination with light walls, preferably cream color or light gray, and a sufficient number of units to enable us to regulate the intensity of the diffused light when artificial light must be used, will do much to overcome bad conditions. Such a plan is expensive, as compared with direct lighting, but the saving in comfort and sight will make it pay.

If the indirect method is not available, a plan which will at all times protect eyes from direct rays and which is susceptible of variation to suit the conditions should be adapted. Frequent rests or change of focus during near work are necessary in order to avoid strain. A good rule is to rest the eyes ten minutes every hour.

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